Beam sizes for a 0.5 GeV/c experiment off the Booster, and 2 GeV/c experiment in the AGS tunnel. The 95% normalized emittance is 15π mm-mrad. The beam size is:

$$x = \sqrt{\beta_x \left(\frac{\varepsilon_x}{\pi \beta \gamma} \right)}$$

The 95% beam size is given in Table 4. β_x is taken from Yuri's JPARC lattice and Thomas Roser's talk at the July, 2003 EDM Collaboration Meeting.

Table 4. Beam parameters for 0.5 GeV/c experiment off the Booster, and 2 GeV/c experiment in the AGS tunnel.

	p = 0.5 GeV/c	**p = 2 GeV/c**
β_x	6.9m	20m
γ	1.035	1.46
β	0.25	0.73
x	20mm	17mm

Simulation of Thin Carbon Target in an AGS-sized Ring

Carbon target is probably not the optimum target. We worked through the statistical sensitivity with a thin Carbon target. The optimized statistical sensitivity will be better.

AGS parameters (since we haven't designed an AGS sized ring lattice).

Normalized transverse emittance (95%)	15π mm-mrad
β_x, β_y	$\approx$20m
Longitudinal emittance per nucleon (total)	0.5 MeV-μs
Average radius	128.5m
Circumference	807.4m
Horizontal tune Q_h	8.7
Vertical tune Q_v	8.8
Synchotron tune Q_s	0.001

Deuteron Carbon hadronic cross-sections at 650 MeV kinetic energy (1.69 GeV/c momentum). Yannis will discuss asymmetry, etc. This is about the energy we would use for a deuteron edm experiment with a circumference of 0.8 km.

Total	456 ± 18 mb
Elastic	131 ± 15 mb
Inelastic	346 ± 9 mb

Radiation Length

	X_0 (g/cm^2)
Carbon	42.7
H_2	61.3
D_2	122.4

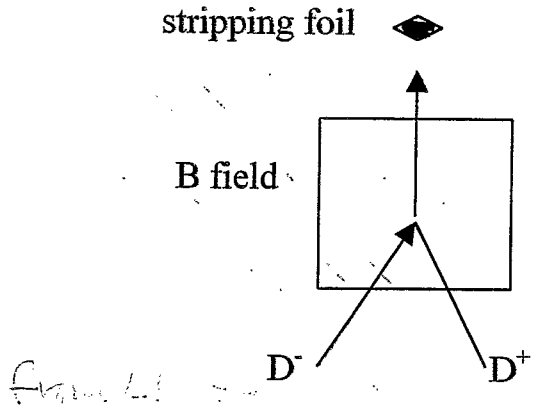
Deuteron p = 1.69 GeV/c.

β	0.67
γ	1.35
Cyclotron period	4.0 μs

Sensitivity Estimates

IUCF, BNL Booster or AGS?

Multi-turn strip injection:



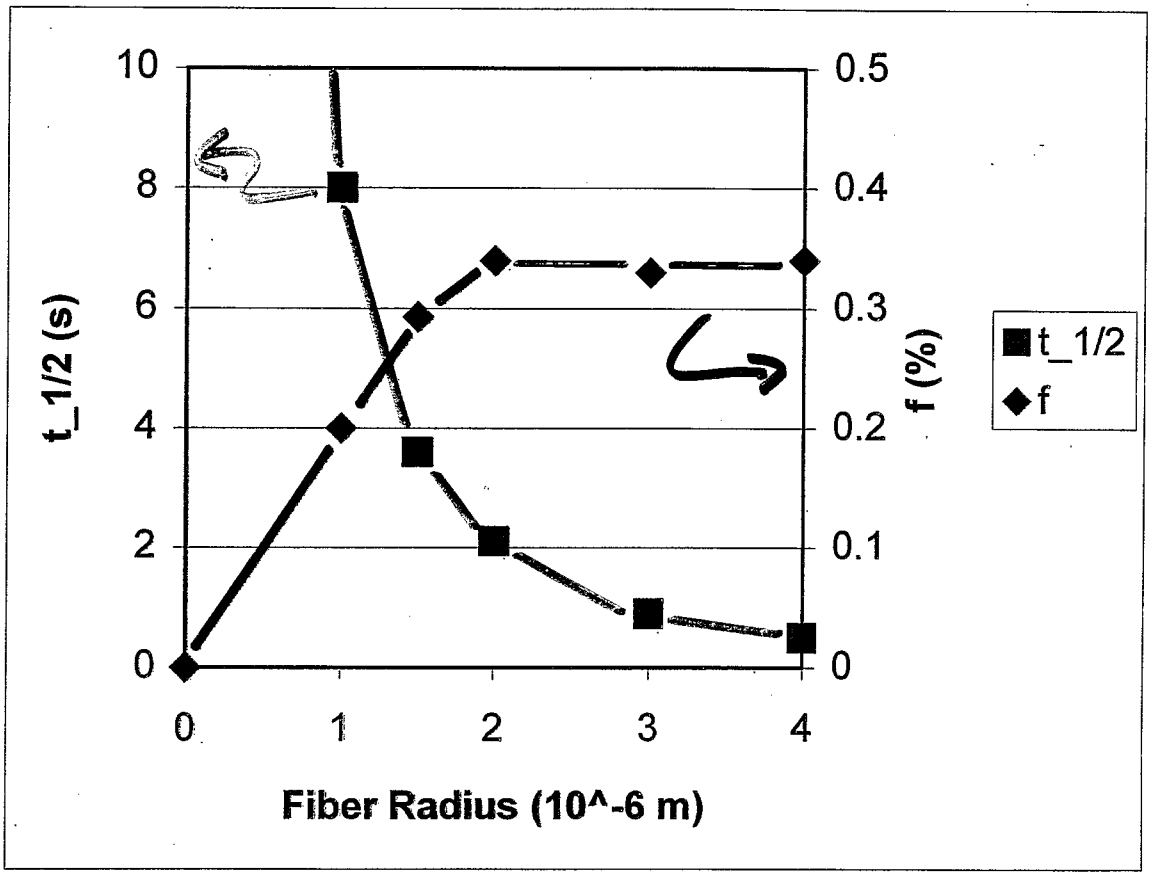
Comparison of Booster and CIS parameters.

	BNL Booster	IUCF CIS
Circumference	202m	17.4m
Injection energy/nucleon	≈20 MeV	3.5 MeV
Polarized D per bunch	$\approx 5 \times 10^{10}$	5×10^{8}

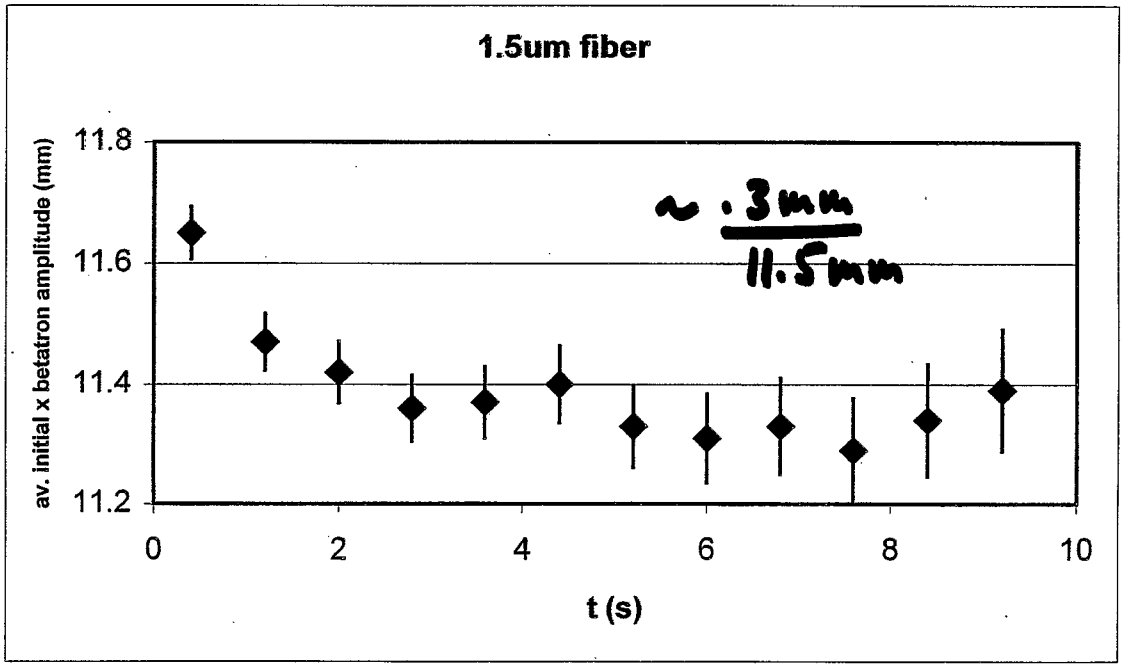
Intensity limited by repeated passes of the D^+ beam through the stripping foil. Favors large circumference and large injection energy.

After multi-turn injection, bump is turned on so D^+ misses foil, R.F. is adiabatically turned on to bunch the beam, accelerate, etc.

Fraction of deuterons which interact hadronically over ten seconds and beam half-life vs. fiber radius.

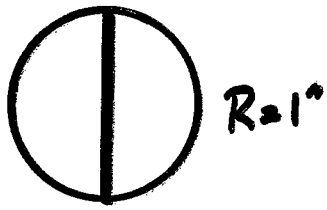


Average initial horizontal betatron oscillation amplitude vs. storage time.



The initial 95% beam size is (normalized $\varepsilon = 15\pi$ mm-mrad):

$$x = \sqrt{\frac{\beta_x \varepsilon}{\pi \beta \gamma}} = \pm 18mm$$



Assumed only phase space x x' initial distribution. Circular collimator with R = 1 inch.

Multiple Coulomb scattering does not de-polarize the beam: storage ring acceptance is only several mrad, cos(450mrad) = 0.9.

4000 deuterons tracked for ten seconds or until lost.